

## ABSOLUTE OPTICAL POSITION DETERMINATION

This application is a continuation-in-part of Ser. No. 07/862,977, filed Apr. 3, 1992 now U.S. Pat. No. 5,477,012.

### FIELD OF THE INVENTION

This invention relates to apparatus and method for generating absolute position related computer data from obtaining and outputting the instantaneous position and/or movement of a moveable element on a data surface, such as might be used for determining the position and/or movement of a pen/pencil on paper. In addition, this invention will allow the user to input graphical information (e.g., drawings or handwriting) and simultaneously provide an original hard copy of the information.

### BACKGROUND-DESCRIPTION OF PRIOR ART

The following United State Patents are believed to be most closely related to the present invention:  
U.S. Pat. Nos.:

5,086,197	5,075,558	5,075,541	5,051,736
5,009,277	4,975,546	4,885,433	4,853,496
4,845,684	4,809,351	4,806,707	4,804,949
4,751,741	4,532,376	4,364,035	4,141,073

Many attempts have been made to determine the position of an object on a data surface in the form of computer data. Both two-dimensional and three-dimensional position determining devices now exist for inputting graphical data such as handwritten text, symbols, drawings, and so on. These devices determine the absolute position and/or movement of a stylus on a data surface by converting the position information into coordinates.

The use of a writing tablet and a stylus is common for inputting hand written data. Most two-dimensional devices require contact between the writing tablet and stylus. Three-dimensional devices usually do not require contact. They normally use a form of wave energy such as light, electromagnetic, or sonic energy.

Generally, two relationships exist between the stylus and the writing tablet. The passive stylus/active tablet utilizes a passive stylus interfacing with an active receiving surface (e.g., resistive and capacitive methods), while the active stylus/passive tablet utilizes an active stylus interfacing with a passive surface (e.g., optical, acoustic, tactile, or electromagnetic). A third method using a mechanical linkage such as a pantograph is rarely used.

The passive stylus/active surface method has some significant shortcomings. The most significant is the active surface or tablet itself. Besides being complex, large, heavy, cumbersome and difficult to transport, the tablet is expensive. Further, the tablet cannot usually distinguish between the stylus and another object pressing on it. Still further, active tablets are difficult to manufacture, subject to interference from outside factors, and have complex mechanical and electrical parts that are subject to malfunction.

The active stylus/passive surface method also has major drawbacks. Most significantly, this method generally requires an awkward tablet besides a separate transmitter and receiver (usually in different locations). Further, the transmitted signal can become obscured before reaching the receiver.

Another class of active stylus/passive surface devices provides relative position information. An example is the

computer mouse that includes the mechanical mouse comprising a ball rolling on a surface, and the optical mouse comprising a surface with grid lines and an optical input means within the mouse.

Both the passive stylus/active surface and active stylus/passive surface methods have the feeling of being unnatural and require a significant interface adjustment for the user from the conventional pen/pencil and paper. The amount and accuracy of information provided by these methods are limited. In addition, some of these methods require a physical connection between the stylus and the tablet. All the methods provide two-dimensional information. Some provide three-dimensional information. Further, they may provide one or more, but not all the following information: displacement, rotation, angle to tablet, and velocity. None provide all of this information.

A significant advantage of the present invention is its interface. Overall, no matter how good a computer interface is, less of it would be better. The present invention allows for an interface that is almost identical to that of a pen/pencil and paper. The present invention is used in the same manner as a pen/pencil and paper and all of the computing is done in the background unnoticed by the user. The present invention turns an ordinary pen/pencil and paper into a powerful computer. The pen/pencil and paper are familiar and comfortable interfaces to the user. If the user is comfortable with the pen/pencil and paper then the user will be very comfortable with the present invention.

As part of output, the aforementioned methods can provide a printed hard copy, but they do not provide an original hard copy as part of the input. In the present invention, the information is input, analyzed, then output. Since the present invention teaches obtaining coordinate information by scanning a surface and simultaneously placing information on the surface by writing on the surface with a stylus, an original hard copy is produced as part of the input by writing or drawing on the surface.

### OBJECTS AND ADVANTAGES

It is an object of the present invention to provide all of the aforementioned information.

It is an object of the present invention to overcome all of the aforementioned disadvantages.

It is an object of the present invention to provide an apparatus and method for obtaining and outputting the absolute position and/or movement of a moveable element on a data surface.

It is an object of the present invention to provide an apparatus and method for obtaining and outputting the absolute position and/or movement of a moveable element on a data surface for acquisition and output of hand written data.

It is an object of the present invention to provide a system that most closely resembles using pen/pencil and paper.

It is an object of the present invention to provide an original hard copy of data as part of the input process of writing on a surface.

It is an object of the present invention to provide an apparatus and method of the character described in which the absolute position and/or movement of the movable element can be precisely determined relative to a fixed reference.

It is an object of the present invention to provide an apparatus for hand held use.

It is an object of the present invention to provide the aforementioned movable element in the shape of a stylus.

3

It is an object of the present invention to provide an apparatus of the character described which does not require the use of a special digitizing tablet.

It is an object of the present invention to provide an apparatus of the character described which does not require the use of a special transmitter.

It is an object of the present invention to provide an apparatus of the character described which can use a writing surface such as paper formatted with a position-related coding means for indicating X-Y coordinates.

It is an object of the present invention to provide an apparatus of the character described which can use a writing surface such as paper formatted with a position-related coding means for indicating X-Y coordinates by the stylus at the time of use.

It is an object of the present invention to provide an apparatus and method for obtaining and outputting the position and/or movement of a moveable element on a data surface comprising: a writing surface formatted with a position-related coding means for indicating X-Y coordinates, an optical data input means or detector means, a data processing means, and a data output means.

It is an object of the present invention to provide an apparatus and method for precisely locating the absolute position and/or movement of a movable element within a plane. More particularly, it is an object of the invention to provide an input/output apparatus for use with a computer that includes a movable element, whose absolute position and/or movement within a plane can be determined with or without a physical connection between the movable element and the plane.

It is an object of the present invention to provide an apparatus and method for handwriting recognition.

It is an object of the present invention to provide an apparatus and method for optical character recognition (OCR).

It is an object of the present invention to provide an apparatus and method for signature verification.

It is an object of the present invention to provide an apparatus and method for handwriting verification.

It is an object of the present invention to provide an apparatus and method for finger print recognition.

It is an object of the present invention to provide an apparatus and method for graphical recognition.

It is an object of the present invention to provide an apparatus and method for graphical input.

It is an object of the present invention to provide an apparatus and method for forms processing.

It is an object of the present invention to provide an apparatus and method for converting optically input data into coordinate data.

It is an object of the present invention to provide an apparatus and method for formatting a writing surface with coordinate data.

It is an object of the present invention to provide an apparatus and method for formatting a writing surface with coordinate data including (1) printing the writing surface with coordinate codes, (2) overlaying a writing surface with carbon paper, film, template, plate, or the like comprising the coordinate code, or overlaying a surface with at least one coding means, and (3) formatting the writing surface by writing on it while scanning, then using the written data for coordinates.

It is an object of the present invention to provide an apparatus and method for formatting a writing surface with

4

coordinate data including (1) printing the writing surface with coordinate codes using ink that reflects only the desired frequency(s) of light, (2) overlaying a writing surface with a carbon paper, film, template, plate, or the like comprising the coordinate code whereby the code reflects the particular frequency of light and/or pattern to be scanned, or overlaying a surface with at least one coding means reflecting the particular frequency of light and/or pattern to be scanned, and (3) formatting the writing surface by writing on it while scanning, then using the written data as points of reference.

It is an object of the present invention to provide an apparatus and method for providing analog data.

It is an object of the present invention to provide an apparatus and method for providing digital data.

It is an object of the present invention to provide an apparatus and method for digitizing optical data.

It is an object of the present invention to provide an apparatus and method for learning a data surface.

It is an object of the present invention to provide a data surface is made of a material selected from the group consisting of paper, plastic, glass, metal, synthetic fiber, synthetic material, natural material, and a paper like substance.

#### DESCRIPTION OF DRAWINGS

FIG. 1 is an example of a coding means using dots.

FIG. 1a is an enlarged view of the coding means in FIG. 1.

FIG. 2 is an example of dots representing coordinates.

FIG. 3 is an example of written text on a coded writing surface of dots.

FIG. 4 is an example of a coding means using bar codes.

FIG. 4a is an enlarged view of the coding means in FIG. 4.

FIG. 5 is an example of a coding means using checkerboard-like cubes.

FIG. 5a is an enlarged view of the coding means in FIG. 5.

FIG. 6 is a perspective view of an embodiment using an image conduit and a PC board.

FIG. 7 is a perspective view of an embodiment using a self-contained stylus.

#### REFERENCE NUMERALS IN DRAWINGS

1	coded surface	2	dot
3	quadrant of dot	4	center circle
5	inner ring	6	outer ring
7	ring slices	8	optical conduit
9	writing element	10	pressure switch
11	manual switch	12	lens or light filter
13	CCD	14	electronic interface
15	cable	16	PC board
17	light source	18	protective casing
19	optical element	20	lens
21	microcomputer	22	touch screen display
23	function keys	24	wireless transceiver
25	pen/pencil clip		

#### DESCRIPTION OF PREFERRED EMBODIMENTS

The present invention aims to overcome the aforementioned disadvantages and to provide a system that most closely emulates the use pen/pencil and paper.